

**CERTIFICATE OF COMPLIANCE  
FOR RADIOACTIVE MATERIAL PACKAGES**

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2. PREAMBLE

- a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."
  - b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.
3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

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| a. ISSUED TO ( <i>Name and Address</i> )<br>Framatome Inc.<br>2101 Horn Rapids Road<br>Richland, WA 99354 | b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION<br>Framatome Inc. application dated March 31, 2021. |
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4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.  
(a) Packaging

- (1) Model Nos.: MAP-12 and MAP-13
- (2) Description

The MAP package is designed to transport unirradiated uranium fuel assemblies with enrichment up to 8.0 weight percent. The package is designed to carry two fuel assemblies with core components. The package consists of two components: a base and lid. The containment system of the MAP package is the fuel rod cladding.

The base consists of a fixed stainless steel strong-back which supports the fuel assemblies. A series of inner stiffeners are secured to the underside of the strong-back to support the fuel assemblies. A neutron moderator and absorber are positioned directly beneath the strong-back between each inner stiffener. The base inner stiffeners are retained by a stainless steel cover. Exterior to the cover is a layer of rigid polyurethane foam and a stainless steel outer shell. A second stainless steel sheet is provided between the two middle stiffeners. Four stainless steel outer stiffeners support the package base. The payload rests on the "W" shaped strong-back (referred to as a W-plate) and is held in place with hinged and latched aluminum doors. The lid is very similar to that of the base – a "W" shaped stainless steel inner shell is fitted with a series of inner stiffeners, neutron moderator and absorbers, and a stainless steel cover is fitted over the stiffeners. The lid is fitted with trapezoidal impact limiters at each end. The impact limiters are constructed from rigid polyurethane foam encased by the package outer stainless shell skin. The base and lid include end plates with interlocking, interfacing angles.

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5.(a)(2) Description (continued)

There are two models of the MAP package, the MAP-12 and MAP-13. The weights and dimensions of the package are as follows:

MAP-12 (for 144-in Maximum Nominal Active Fuel Length):

Maximum Gross Weight	8,630 lbs
Maximum Payload Weight	3,400 lbs
Outer Dimensions	
Length	208 in
Width	45 in
Height	31 in

MAP-13 (for 150-in Maximum Nominal Active Fuel Length):

Maximum Gross Weight	8,930 lbs
Maximum Payload Weight	3,400 lbs
Outer Dimensions	
Length	221 in
Width	45 in
Height	31 in

(3) Drawings

The MAP-12 and MAP-13 packages are fabricated and assembled in accordance with the following Framatome Inc. Drawing Nos.:

9045393, Rev. 9;	9045402, Rev. 6;
9045397, Rev. 3;	9045403, Rev. 6;
9045399, Rev. 4;	9045404, Rev. 5;
9045401, Rev. 6;	9045405, Rev. 6.

(b) Contents

(1) Type and Form of Material

(i)  $\leq$  5.0 weight percent U-235

Enriched commercial grade uranium or slightly contaminated uranium with trace quantities limits as defined in Table 1 below. Uranium oxide fuel rods, enriched to no more than 5.0 weight percent in the U-235 isotope, with limits specified in Table 1 below.

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5.(b) Contents (continued)

(ii) > 5.0 to ≤ 8.0 weight percent U-235

Enriched commercial grade uranium or slightly contaminated uranium with trace quantities limits as defined in Table 2 below.

Uranium oxide fuel rods in the 17x17 Type 3 array, enriched to no more than 8.0 weight percent in the U-235 isotope, with limits specified in Table 2 below.

(2) Maximum Quantity of Material per Package

Table 1: Maximum Authorized Concentrations for ≤ 5.0 weight percent U-235

Isotope	Maximum Content
U-232	$2.00 \times 10^{-9}$ g/g U
U-234	$2.00 \times 10^{-3}$ g/g U
U-235	$5.00 \times 10^{-2}$ g/g U
U-236	$2.50 \times 10^{-2}$ g/g U
U-238	Balance of Uranium
Np-237	$1.66 \times 10^{-6}$ g/g U
Pu-238	$6.20 \times 10^{-11}$ g/g U
Pu-239	$3.04 \times 10^{-9}$ g/g U
Pu-240	$3.04 \times 10^{-9}$ g/g U
Gamma Emitters	$6.38 \times 10^5$ MeV – Bq/kg U

Maximum content of U-238 is  $9.23 \times 10^{-1}$  g/gU for a maximum U-235 concentration of 5%. Since, for concentrations less than 5%, the U-238 value will be higher, it is shown as "Balance of Uranium" in Table 1.

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5.(b) Contents (continued)

Table 2: Maximum Authorized Concentrations for > 5.0 to ≤ 8.0 weight percent U-235

Isotope	Maximum Content
U-232	$1.10 \times 10^{-7}$ g/g U
U-234	$1.30 \times 10^{-2}$ g/g U
U-235	$8.00 \times 10^{-2}$ g/g U
U-236	$2.50 \times 10^{-2}$ g/g U
U-238	Balance of Uranium
Np-237	$1.66 \times 10^{-6}$ g/g U
Pu-238	$6.20 \times 10^{-11}$ g/g U
Pu-239	$3.04 \times 10^{-9}$ g/g U
Pu-240	$3.04 \times 10^{-9}$ g/g U
Gamma Emitters	$6.38 \times 10^5$ MeV – Bq/kg U

Maximum content of U-238 is  $8.82 \times 10^{-1}$  g/gU for a maximum U-235 concentration of 8%. Since, for concentrations less than 8%, the U-238 value will be higher, it is shown as "Balance of Uranium" in Table 2.

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5.(b) Contents (continued)

(3) Fuel Assembly

- (i) The parameters of the authorized fuel assemblies for  $\leq 5.0$  weight percent U-235 are specified in Table 3 below.

Table 3: Fuel Assembly Parameters for  $\leq 5.0$  weight percent U-235

Fuel Rod Array	14x14		15x15				16x16	17x17		
	1	2	1	2	3	1	1	2		
Assembly Type	1	2	1	2	3	1	1	2		
No. of Fuel Rods	176	179	208	216	204	236	264	264		
No. of Non-Fuel Cells	20	17	17	9	21	20	25	25		
Nominal Fuel Rod Pitch (in)	0.580	0.556	0.568	0.550	0.563	0.506	0.502	0.496		
Maximum Pellet Outer Diameter (in)	0.3812	0.3682	0.3622	0.3707	0.3742	0.3617	0.3682	0.3282	0.3252	0.3232
Minimum Fuel Rod Outer Diameter (in)	0.438	0.422	0.414	0.428	0.428	0.414	0.422	0.380	0.377	0.372
Minimum Clad Wall Thickness <sup>(a)</sup> (in)	0.0245	0.0230	0.0220	0.0245	0.0230	0.0220	0.0230	0.0220	0.0220	0.0205
Minimum Guide Tube Wall Thickness (in)	N/A	N/A	0.0140	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Minimum Guide Tube Outer Diameter (in)	N/A	N/A	0.528	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Guide Tubes	N/A	N/A	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Minimum Instrument Tube Wall Thickness (in)	N/A	N/A	0.0240	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Minimum Instrument Tube Outer Diameter (in)	N/A	N/A	0.491	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of Instrument Tubes	N/A	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Clad/Tube Material Type <sup>(a)</sup>	Zr Alloy	Zr Alloy	Zr Alloy	Zr Alloy	Zr Alloy	Zr Alloy	Zr Alloy	Zr Alloy	Zr Alloy	Zr Alloy
Maximum Active Fuel Length (in)	160	160	160	160	160	160	160	160	160	160

(a): the clad tube/material may include chromium coated cladding. The thickness of the cladding (maximum 20  $\mu\text{m}$ ) is not included as part of the minimum clad wall thickness.

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5.(b) Contents (continued)

- (ii) The parameters of the authorized fuel assemblies for  $\leq 8.0$  weight percent U-235 are specified in Table 4 below.

Table 4: Fuel Assembly Parameters for  $\leq 8.0$  weight percent U-235

Fuel Rod Array	17x17
Assembly Type	3
No. of Fuel Rods	264
No. of Non-Fuel Cells	25
Nominal Fuel Rod Pitch (in)	0.496
Maximum Pellet Outer Diameter (in)	0.3254
Minimum Fuel Rod Outer Diameter (in)	0.372
Minimum Clad Wall Thickness <sup>(a)</sup> (in)	0.0205
Minimum Guide Tube Wall Thickness (in)	N/A
Minimum Guide Tube Outer Diameter (in)	N/A
Number of Guide Tubes	N/A
Minimum Instrument Tube Wall Thickness (in)	N/A
Minimum Instrument Tube Outer Diameter (in)	N/A
Number of Instrument Tubes	N/A
Clad/Tube Material Type <sup>(a)</sup>	Zr Alloy
Gadolinia Requirements # @ wt% Gd <sub>2</sub> O <sub>3</sub> Lattice Average Enrichment <sup>(b)</sup>	
$\leq 8.0$ wt% U-235	12 @ 2 wt.%
$\leq 7.0$ wt% U-235	10 @ 2 wt.%
$\leq 6.5$ wt% U-235	8 @ 2 wt.%
$\leq 6.0$ wt% U-235	4 @ 2 wt.%
$\leq 5.0$ wt% U-235	No Gadolinia requirements
Maximum Active Fuel Length (in)	150

- (a): The clad tube/material may include chromium coated cladding. The thickness of the cladding (maximum 20  $\mu\text{m}$ ) is not included as part of the minimum clad wall thickness.
- (b): Required gadolinia rods must be distributed symmetrically along the major diagonal.

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(3) Fuel Assembly (continued)

- (ii) Non-fissile base-plate mounted and spider body core components are permitted.
- (iii) Fuel rods assembled into the fuel assemblies are those loaded with sintered pellets of uranium oxides and/or with sintered pellets of uranium oxides mixed with various additives (e.g., Chromium, Boron, Gadolinium, and Europium).

(c) Criticality Safety Index for contents described in Table 1 and Table 3 for  $\leq 5.0$  weight percent U-235: 2.8

Criticality Safety Index for contents described in Table 2 for  $\leq 7.0$  weight percent U-235: 8.4

Criticality Safety Index for contents described in Table 4 for  $\leq 8.0$  weight percent U-235: 25

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

- (a) The package shall be prepared for shipment and operated in accordance with the Package Operations in Section 7 of the application, as supplemented.
- (b) Each package must meet the Acceptance Tests and Maintenance Program of Section 8 of the application, as supplemented.
- (c) Each fuel assembly must be unsheathed or must be enclosed in an unsealed, polyethylene or polypropylene sheath, which may not extend beyond the ends of the fuel assembly. The ends of the sheath may not be folded or taped in any manner that would prevent the flow of liquids into or out of the sheathed fuel assembly.
- (d) The fuel rods must be leak tested after fabrication to ensure that the leakage rate of the containment boundary is less than  $10^{-7}$  ref cc/sec.

7. Transport by air of fissile material is not authorized.

8. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

9. Revision No. 12 of this certificate may be used until December 31, 2022.

10. Expiration date: February 28, 2023.

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REFERENCES

Framatome Inc., application "MAP PWR Fuel Shipping Package, FS1-0038397, Revision No. 5, dated March 31, 2021.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION



Signed by Diaz-Sanabria, Yoira  
on 12/16/21

Yoira Diaz-Sanabria, Chief  
Storage and Transportation Licensing Branch  
Division of Fuel Management  
Office of Nuclear Material Safety  
and Safeguards

Date: December 16, 2021

